Japanese roads have been developed and improved in full gear since the 1950’s with sufficient funds raised from the “Road Ear-marked Taxation System” and “Toll Road System”, which were introduced respectively in 1954 and 1952. In particular, the Toll Road System has been widely adopted for the development and improvement of arterial highways including the Metropolitan Expressway in Tokyo. As a result, the total length of toll roads has now reached about 11,000 km, 1,400 km of which have already been made free of charge, as the amortization of the borrowed money was completed.

The share of goods transported on toll roads has also reached 17% on the ton-km basis, because all national and urban expressways have been developed and improved as toll roads, and longer trips tend to use toll roads rather than ordinary roads which cannot guarantee steady and high speed transport.

Under these circumstances, it is said that the introduction of ETC (Electronic Toll Collection System) to toll roads will have tremendous impact not only on the progress of ITS (Intelligent Transport Systems) but also on the advancement of social and economic activities in Japan. Hence, ITS has already been regarded as the most important part of the “IT Revolution” in Japan. ITS is categorized into 9 areas as shown in Fig. 1 and ETC is now considered as the second runner following the navigation system in terms of promoting ITS in Japan (Image of Japanese ETC is shown in Fig. 2).

**Concept 1: Common system throughout toll roads in Japan**

Since toll roads in Japan have formed an arterial highway network and there are numerous toll road operators, it would be extremely inconvenient for toll road users if toll road operators would adopt different ETC standards. Therefore, it was unanimously agreed that the first concept must be a “common system under common standards” so that toll road users can pass through all toll gates with the same transponders.

**Concept 2: High security**

The annual revenues raised from toll roads amount to approximately...
mately two trillion yen in Japan. In addition, in case of long trips, tolls per trip often exceed ten thousand yen (about one hundred US$ per trip). Therefore, high security is required for Japanese ETC. It was decided that the Japanese ETC is structured under the most advanced and sophisticated encoding system in the world.

**Concept 3: Utilization of existing toll gates**

It is unrealistic that existing toll gates which have already been equipped with sophisticated communication systems would be dismantled shortly after the introduction of ETC. In addition, it is unlikely that all toll road users will come to use ETC instead of current payment methods within a short period. Therefore, it was decided that existing toll gates will be utilized for the time being after introducing ETC.

**Concept 4: 100% use of ETC in the future**

Although it is impossible to have all toll road users use ETC in a short period, it is necessary for ETC standards to enable 100% use of ETC in the future. For this reason, a two-piece system consisting of IC cards and OBUs (On Board Units) has been proposed and adopted for Japanese ETC, because 100% use of ETC will be attainable in the future when all credit cards are replaced with IC cards and every automobile is equipped with OBU during assembly.

Japanese ETC is now at the final test-run stage in the Tokyo Metropolitan Area and about 33,000 monitors participate in this final test-run to finalize the R&D of ETC. It has already been announced that toll road users will be able to use ETC in the Tokyo Metropolitan Region starting from March 30, 2001. It has also been announced that ETC will be installed at about 900 toll gates in Japan including all toll gates on the Metropolitan Expressway by the end of FY2002.

The following direct impacts of ETC are expected on the Metropolitan Expressway.

- Enhancement of toll road user service level to enable cashless and non-stop payment at toll-gates;
- Reduction in congestion at toll gates (see Table 1) in proportion to prevalence ratio of ETC;
- Improvement of air pollution nearby toll gates in proportion to prevalence ratio of ETC; and
- Improvement of toll collection operation and management with mechanization and computerization of toll collection systems.

At present, flat toll rates for three toll spheres (Tokyo, Kanagawa and Saitama) have been adapted to shorten toll transaction time and avoid traffic congestion in front of toll gates to the extent possible. When the ETC users increase in number and become the majority of toll road users, it will become easier to introduce various tolling systems which will benefit only ETC users. For example, it will be possible to adapt short distance discount only for ETC users when they become the majority. On the other hand, it should be understood that the promotion of ETC will contribute to not only users’ convenience but promotion of the “IT revolution” in Japan. For this reason, the Metropolitan Expressway Public Corporation now aims at hammering out effective prevalence measures, in particular, ETC user favored tolling systems in cooperation with other toll road operators and the private companies concerned.

<table>
<thead>
<tr>
<th>Payment Methods</th>
<th>Share (%)</th>
<th>Average Passing Time through Toll Gates (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>51%</td>
<td>12 (300 vehicles per hour)</td>
</tr>
<tr>
<td>Prepaid Magnetic Cards</td>
<td>12%</td>
<td>8 (450 vehicles per hour)</td>
</tr>
<tr>
<td>Coupon Ticket (Prepaid)</td>
<td>37%</td>
<td>5 (720 vehicles per hour)</td>
</tr>
<tr>
<td>ETC</td>
<td>—</td>
<td>4.5* (850 vehicles per hour)</td>
</tr>
</tbody>
</table>

* Results of ETC experiment on Odawara-Atsugi Highway (JH)